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ORIGINAL ARTICLE

Evaluation of Seed Yield, Yield Components and Some Main Crop Traits in 25 Lentil Genotypes under Rain fed and Irrigated in Various Environments

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ABSTRACT

To study the seed yield, yield components and some main crop traits in 25lentil genotypes, including 23Ardabil local genotypes and 2control genotypes, a research was conducted at Ardabil Islamic Azad University Agricultural Research Stations at Hasan Baruq and Alaruq, during 2010 and 2011, respectively. In each year, two rain fed and irrigated planting experiments were carried out in randomized complete block design (RCBD). According to the combined analysis of variance results between two environments, there was a significant difference found between seeds large diameter. Also, there was a significant difference found between rain fed and irrigated conditions in seed large diameter and seed yield. There was a significant difference found between studied genotypes on number of leaflet and seed yield in plot unit. The genotype × environment interaction was significant on number of filled pods, total number of pods, number of seeds per plant, seed weight per plant, seed large diameter, seed weight and seed yield. Genotypes No. 7 and No. 11had the highest yield in Hasan Baruq and Alaruq stations, respectively.

Keywords: *yield, yield components, drought stress*

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INTRODUCTION

Lentil (Lens culinaris Medikus) is a legume like the cold, probably originated from the Near East's Fertile Crescent. Lentils have been two macros perm and macros perm A macros perm group has overcome in the Mediterranean region and Asia. The seeds are large and usually yellow split peas and with very little pigment or no pigment in the flowers or green germination parts macros perm groups have shorter height, more pigment and leaves, leaflets and pods are smaller than macros perm groups. Macros perm group are the dominant in the Indian subcontinent and parts of the Near East. Seedlings are less than 6 mm (diameter) with orange or yellow split peas [1].it is obvious that lentil plant can do Protein supply and nitrogen fixation of by its roots, Which can be an important crop in the rotation cycle of the plants, especially in leguminous family. Lentil crop acreage is 220,000 ha in Iran which 92% is grown in dry land conditions [2]. Lentil is one of the most digestible Beans that is Valuable source of protein which is 25 percent, And straw, shell pods contain high nutritional value that consume livestock [3]. Iran has limited water sources and by 250mm average rainfall, Iran has one third of the average rainfall in the world [4]. Seed yield and its sustainability in regions with environmental stresses have always been considered as an important criterion in selecting and introducing cultivars [5]. Due to the weak compensatory growth in grains, reproductive organs long-term differentiation and high impact of external factors on forming such organs, the production and economic efficiency of such crops have a more complex process, comparing to other grain crops. Grains reaction to temperature and humidity during germination, growth, pollination and grain filling is critical. Excessive temperature during flowering could affect the crop. Among the main factors which result in low yield are low yield potential and local genotypes' incompatibilities with rain fed conditions [6]. Water shortages are among the main factors which decrease the yield in most regions [7]. A vast majority of breeding studies are focusing on plant modification and reactions to water shortages [8]. Hence, identifying plants which could survive such environmental conditions with higher yield and also studying the survival mechanisms seem to be of the most significance in defeating drought [9].

The following research tries to study the seed yield, yield components in various lentil genotypes under two rain fed and irrigated conditions in various environments during two years.

MATERIALS AND METHODS

These experiments were conducted, in the fields of agricultural research stations of Islamic Azad University, Ardebil, Alarouq station during 2010 and 2011. University Agricultural Research Station are located 5 km northwest of the city of Ardabil (Hassan Barouq) and the Agricultural Research Station of Ardabil (Alarouq) at 12 km south of Ardabil (khalkhal Road). This station has a semi-arid climate and cold temperatures in winter are often below zero. Some properties of this region are Altitude 1350 m and average rainfall of 307.1 mm and the latitude 48.20 east longitudes and north latitude 38.15. The average annual minimum and maximum temperatures are, respectively, -1.98 and 15.18 and so, 21.8 ° C is the maximum absolute temperature. Hassan Barouq soil is clay alluvial type and PH is between 7.8 to 8.2. Alarouq soil is Clay loam type , in term of amount of organic matter is poor i.e. 7 %. Soil phosphorus and potassium, respectively ppm12 and ppm400 and electrical conductivity of soil 1mili mouse and pH of soil is about 7.7 and Ph of water is 7.1.

Randomized complete block experimental design was used in each experiment. Each year, two experiments were conducted under rain fed and irrigated. For each of rain fed and irrigated conditions were considered, 3 and 2 replicates respectively. In this experiment, 23 native lentil genotypes with two genotypes as a control were determined. Seed samples was prepared from cereals sector, agricultural research center located in a village 12 km south of Alarouq in Ardebil.

Bed preparation operations include:

Ground preparation: Operations including deep plowing and land preparation in mid April took her drive to establish experimental plots in May.

Planting: Each variety consists of 4 lines 2.5 meters, the distance 25 cm from each other, so planting was in the first half of May. The lateral two lines were as the margin and middle two line was considered as a resource for each treatment.

Handling: The main problem was in the weeds. Because most weeds are dominant over the lentils. Thus carried hand-weeding out mostly in 2 to 4 leaf stage of weeds. The weeding was about 3 to 4 times, the irrigated operation was carried out regularly without stress.

Harvesting: When the lentils reach to ripening stages, crops harvested by considering both sides and 20 cm from the beginning and end of the line as the border between the middle lines as calculating performance.

The traits that were evaluated during testing are following:

The small and large diameter grains, The number of full pod, Total number of pod, The number of seeds per plant, Grain yield per plant, 100 seed weight, the number of leaflets (leaflets from 10 plants per experimental unit were counted and then calculated the average number of leaflets per plant)., Grain yield in each experimental unit (Removing the margins, The entire remaining part of the test material and seed weight was calculated). The amount of seed weight per plant as the sample was collected and calculated from each experimental unit. And finally, as the number of grain yield was recorded in the experimental unit. In any of the methods according to need and was used MSTATC & SPSS software.

RESULTS AND DISCUSSION

Table 1 presents the combined analysis of variance in two environments under two plating conditions. Except the seed large diameter trait, there was a significant difference between all studied traits at 1%. Table 2 indicates that Hasan Baruq station had a higher value in most traits. There was a significant difference found between two plating conditions (irrigated and rain fed) on seed large diameter and seed yield in plot unit at 5% (Table 1). Comparing to rain fed conditions, seed yield in plot unit was higher in irrigated conditions. However, seed large diameter in rain fed conditions had a higher value (Table 2) Grains are among plants which have different yields during years. Water shortages are among the main factors, in this regard [10]. Number of pods has the highest effect on plant yield in grains.Water shortages has the highest effect on lentil yield components and leads to decrease in pod production in plant and seed production in pod and also decrease in seeds weight. Hence, irrigation could result in increase in pod production in plant and seed production in pod and also increase in seeds weight. Lentil seed yield decreases under water shortages conditions. In another report, it was claimed that three times irrigation during seed filling period could increase lentil yield. Azadi et al (2006) reported that increase in stress intensity leads to significant decrease in yield and yield components.

Table 1 suggests that there is a significant difference between seed yield and number of leaflets, so that, genotypes No. 19, No. 7 and No. 11 had the highest seed yield, respectively. Genotype No. 22 had the highest number of leaflets (Table 4). Various factors affect the low yield in lentil. Drought tolerance is a quantitative trait and there is no direct method to measure it. This problem has hardened identifying drought resistive genotypes [11] . However, seed yield in without stress and drought stress conditions seem to be a good starting point for choosing genotypes which are compatible by planting in drought condition [12 and 13]. Low yield potential and lack of compatibility between local cultivars and rain fed conditions are among the main factors in lentil low yield [6]. Differences in plant yield potentials are mostly due to the stress compatibility factors, rather than the stress tolerance itself. Hence, drought stress tolerance indices are considered in determining the resistive genotype s in these conditions [14].

Table 1- Combined Analysis of Variance for 25 Lentil Genotypes in Two Environments (Alaruq and Hasan Bauq Stations) under Two Rain fed and Irrigated Conditions

S.O.V	**df**	**MS**								
		Number of full pod	Total number of pods	number of grain per plant	Weight of grain per plant	Small diameter grains	Large diameter grains	100 seed weight	Grain Yield(in plot)	Number of Leaflets
Environment	1	133.090**	13041.287**	185.130**	2.401**	2.046**	0.020 ns	67.066**	186.924**	24.626**
Conditions	1	3.308ns	684.019ns	3.535ns	0.044ns	0.150ns	0.504*	6.678 ns	76.072*	18.338 ns
E× C	1	0.502ns	376.779**	0.537ns	0.085*	0.039ns	0.001 ns	0.379 ns	0.077 ns	34.478**
Error 1	6	2.237	12.232	2.187	0.019	0.076	0.169	2.952	9.185	0.797
Genotype	24	1.105ns	38.884ns	1.500ns	0.027ns	0.056ns	1.060 ns	1.946 ns	7.282*	1.186
G×E	24	0.874**	25.389**	1.245**	0.017*	0.061*	1.142**	1.767**	4.416*	0.610 ns
G×C	24	0.154ns	10.209ns	0.171ns	0.009ns	0.025ns	0.173 ns	0.310 ns	2.151 ns	0.462 ns
G×E×C	24	0.276ns	11.555*	0.259ns	0.015ns	0.016ns	0.255 ns	0.340 ns	2.277 ns	0.584 ns
Error 2	144	0.418	21.600	0.453	0.011	0.033	0.276	0.479	2.557	0.904
CV%	-	21.35	29.01	5.93	26.69	6.71	8.28	10.88	20.12	10.21

The genotype × environment interaction was significant on number of filled pods, total number of pods, number of seeds per plant, seed weight per plant, seed large diameter, seed weight and seed yield (Table 1). As it was mentioned before, number of filled pods, total number of pods and number of seeds per plant traits were higher in Hasan Baruq station. Studied genotypes reactions to the environment on these traits are considerable . Due to the interaction between genotype and environment, evaluating new cultivars in various environments by modifiers seems to be essential. Since, popular analysis methods such as combined analysis of variance could only provide information on interaction between genotype and environment; researchers have applied various criteria for to determine the cultivars sustainability and introduction [15]. The interaction between genotype × environments is among the main issues in breeding which has a great role in developing modified cultivars. Genotype interaction in the environment indicates the various reactions to various environments; that is, the best genotype in an environment is not necessarily the best genotype in other environments [16].

Table 2- Studied Traits Total Mean in Two Environments under Two Rain fed and Irrigated Conditions

Traits	Environment		Conditions	
	Hasan Bauq	Alaruq	Rain fed	Irrigated
Number of full pod	18.5	5.15	10.37	13.26
Total number of pods	26.25	7.95	14.84	19.36
Number of grain per plant	17.76	4.91	7.91	14.73
Weight of Grain per plant	1.53	0.29	0.84	0.98
Small diameter grains	2.62	2.82	2.703	2.72
Large diameter grains	6.27	6.33	6.34	6.23
100 seed weight	6.76	5.83	6.14	6.442
Grain Yield(in plot)	92.58	52.26	59.44	85.40
Number of Leaflets	9.83	8.97	9.02	9.78

Except genotype No. 11, seed weight per plant mean was higher in Hasan Bauq station, comparing to Alaruq station. Genotype No. 7 on seed small diameter and genotype No. 3 on seed large diameter showed no changes in both environments. Except genotypes No. 4, No. 6, No. 7 and No.11, seed weight mean was higher in Hasan Bauq station, comparing to Alaruq station. Also, seed yield mean in Hasan Baruq in all studied genotypes was higher than Alaruq station. Akbari Moqaddam et al. (2004) showed that stress, both at the beginning and at the end of growth season result in decrease in seed yield and biomass, so that decrease in seed yield and biomass in initial growth season stress was 37% and decrease in seed yield at the end of growth season was 116% and decrease in biomass was 36%. To achieve a higher seed yield in grains, increase in dry matter accumulation after flowering is more favorable. This is more noticeable in comparing the dynamicity of dry matter accumulation in old and new grains cultivars. Having higher dry matter production after growing shoots, is among characteristics of new cultivars [17]. Temperature applies limitations on seed weight and yield during grain filling period through reducing the grain filling period. Environmental conditions affect plant metabolic activities and cold and heat stresses could lead to reduce the grain filling period or even stop the grain growth [18]. Water shortages stress in soy results in decrease in number of flowers, number of pods, pods size, number of seeds in pod and seeds weight [19].

Table 3- Assessed Traits Mean

Genotype	**Traits**						
	Number of full pod	100 seed weight (gr)	Number of Leaflets	large diameter grains (mm)	small diameter grains (mm)	Weight of grain per plant (gr)	Grain Yield (gr/plant)
1	12.02	6.769	9.60	6.35	2.690	0.386	49.98
2	10.68	6.173	9.18	6.57	2.646	0.359	61.69
3	11.81	6.961	9.65	6.82	2.543	0.419	65.351
4	12.75	6.240	8.74	6.14	2.731	0.407	65.652
5	11.38	5.900	9.01	6.30	2.737	0.346	53.244
6	8.06	6.258	9.60	6.14	2.728	0.375	50.431
7	17.54	5.402	9.67	5.88	2.845	0.439	98.865
8	9.32	6.736	9.14	6.45	2.753	0.373	63.822
9	12.62	6.228	9.69	6.24	2.894	0.395	68.272
10	10.10	6.457	9.72	6.28	2.612	0.400	51.111
11	16.55	5.922	9.60	6.09	2.738	0.574	90.151
12	14.04	5.427	9.27	5.86	2.745	0.4615	87.421
13	10.23	7.134	9.26	6.83	2.636	0.469	70.657
14	12.76	5.722	9.40	5.89	2.730	0.418	77.559
15	14.85	6.356	8.84	6.54	2.690	0.490	74.191
16	11.23	6.365	9.48	6.06	2.720	0.454	87.652
17	10.30	6.563	9.22	6.85	2.770	0.340	43.760
18	11.95	6.902	9.35	6.70	2.737	0.354	69.498
19	11.08	6.877	9.10	6.63	2.544	0.421	94.466
20	7.95	6.672	9.41	6.82	2.657	0.349	49.590
21	10.89	6.442	9.45	6.28	2.731	0.406	66.988
22	12.45	5.776	10.15	5.66	2.750	0.384	82.627
23	11.78	5.657	9.04	6.06	2.543	0.392	77.286
24	10.66	6.843	9.92	6.40	2.801	0.362	69.923
25	12.56	5.503	9.47	5.59	2.749	0.376	73.091

Table 4- Significant Qualified F Traits Mean in Combined Analysis of Variance in Two Environments under Two Planting Conditions

Genotype	Traits	
	Grain Yield (gr/plant)	Number of Leaflets
1	49.980	9.60
2	61.690	9.18
3	65.351	9.65
4	65.652	8.74
5	53.244	9.01
6	50.431	9.60
7	98.865	9.67
8	63.822	9.14
9	68.272	9.69
10	51.111	9.72
11	90.151	9.60
12	87.421	9.27
13	70.657	9.26
14	77.559	9.40
15	74.191	8.84
16	87.652	9.48
17	43.760	9.22
18	69.498	9.35
19	94.466	9.10
20	49.590	9.41
21	66.988	9.45
22	82.627	10.15
23	77.286	9.04
24	69.923	9.92
25	73.091	9.47
LSD	1.413	0.8405

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